FLEXIBLE CONDUCTORS CONNECTED BETWEEN TWO PARTS OF A PORTABLE ELECTRONIC DEVICE

RELATED APPLICATIONS

The present application is a 35 U.S.C. §371 national phase application of PCT International Application No. PCT/EP2003/013000, having an international filing date of Nov. 20, 2003, and claiming priority to European Patent Application No. 02025987.5, filed Nov. 21, 2002, and U.S. Provisional Application No. 60/429,268, filed Nov. 26, 2002, the disclosures of which are incorporated herein by reference in their entireties. The above PCT International Application was published in the English language and has International Publication No. WO 2004/046900 A2.

TECHNICAL FIELD OF THE INVENTION

The present invention relates to the field of portable electronic devices and more particularly to the electrical interconnection between two parts of the device rotatable round each other as well as to the provision of image captioning units and displays on such rotatable devices.

DESCRIPTION OF RELATED ART

It is within the field of portable electronic devices becoming more and more common to provide the device with electrical circuits in two parts rotatably coupled to each other, in order to keep the device small while at the same time allowing it to be doubled in size when in use. Within the field of cellular phones there are a number of phones existing often being called clamshell phones, where this term is describing of the way the phones are opened. In some of these devices one half or the lid of the device might include a display, while the other or main part includes a keypad for entering data and phone numbers. In order to electrically connect the two halves to each other, there is provided a flex film with connecting leads. The flex film is here in one known example provided from the middle of one half to the middle of a second half, with the flex film being provided in a round loop within the hinge, so that the film cannot be seen. One phone model having this type of structure is the model P2102 V Foma sold by NTT DoCoMo in Japan.

Another device having a flex film is shown in U.S. Pat. No. 6,307,751. This document describes a foldable portable computer having a display in one foldable part and a CPU in another foldable part. Flex film is provided for electrical contact between different parts of the computer in the interior of the device and within the hinge.

It is often desirable to provide a portable electronic device in which the parts can be rotated with approximately 360 degrees in relation to each other, i.e. so that both the inner and outer sides of the two parts of the device can be provided against each other for easier holding in a hand of the user. This is not possible to provide with the flex film solution in the phone model P2102V Foma. When done with the solution in U.S. Pat. No. 6,307,751 there would be considerable stress to the flex film.

U.S. Pat. No. 4,878,293 describes a calculator having a clam shell type of construction, where a first part can be rotated by close to 360 degrees in relation to a second part. The device has a hinge provided along most of the length of two long sides of the two parts and flexible conductors interconnecting the two parts are provided from the interior of one part to the interior of the other part via the interior of the hinge. The conductors are here provided along most the length of the hinge and when one part of the calculator is rotated in relation to the other, the conductors are subject to torsional stress because of the rotational movement. This is no real problem in the described device because the calculator has a long side where the hinge is provided. This solution is however not very usable if the hinge is short or when the side of the hinge is short, because the torsional stress might get too big with the breaking of the flex film as a possible result.

There is thus a need for providing an alternative way of providing electrical contact between two parts of a portable electronic device that can be rotated by approximately 360 degrees and that reduces the stress on the electrical connection.

SUMMARY OF THE INVENTION

The present invention is therefore directed towards solving the problem of providing an alternative way to provide an electrical connection between two parts of a portable electronic device rotatable in relation to each other, that reduces the stress on the electrical connection and that occupies little space in the portable communication device.

One object of the present invention is thus directed towards providing a portable electronic device providing electrical connection between two parts that are rotatable in relation to each other, that limits the stress especially at large rotation angles and where the electrical connection occupies little space in the device.

According to a first aspect of the present invention, these objects are achieved by a portable electronic device comprising:

- a first part including electrical circuits and having an exterior side, an interior side, and top and bottom sides,
- a second part also including electrical circuits and also having an exterior side, an interior side and top and bottom sides,
- at least one hinge connecting the bottom sides of the first and second parts to each other and allowing rotation of one part in relation to the other, and
- at least one first set of flexible electrical conductors connected to the first part at the exterior side adjacent the bottom side thereof and to the second part at the interior side adjacent the bottom side thereof.

A second aspect of the present invention includes the features of the first aspect, wherein the hinge allows rotation of one part with approximately 360 degrees in relation to the other part.

A third aspect of the present invention includes the features of the first aspect, wherein the first set of electrical conductors stretches round the bottom side of the first part when the device is folded.

A fourth aspect of the present invention includes the features of the third aspect, wherein the first set of flexible electrical conductors stretches round the bottom side of the second part when a part is rotated with approximately 360 degrees in relation to the other part.

A fifth aspect of the present invention includes the features of the first aspect, wherein the set of conductors are essentially provided at right angles to both the bottom sides.

Another object of the present invention is to provide a set of flexible electrical conductors, which is easier to replace if being faulty.

This object is achieved by a sixth aspect of the present invention including the features of the first aspect, wherein the first set of flexible electrical conductors is separate from the hinge structure of the device.